



National Weather Service  
1301 Airport Parkway  
Cheyenne, WY 82001  
307-772-2468  
[www.nws.gov/cys](http://www.nws.gov/cys)  
[cys.info@noaa.gov](mailto:cys.info@noaa.gov)



#### Inside this Issue:

<b>Building a Weather-Ready</b>	<b>1</b>
<b>Weather 101: Snowflakes</b>	<b>2</b>
<b>Avalanche Safety Tips</b>	<b>3</b>
<b>El Niño and La Niña</b>	<b>4</b>
<b>El Niño and La Niña Continued</b>	<b>5</b>
<b>El Niño and La Niña</b>	<b>6</b>
<b>Winter Weather</b>	<b>7</b>
<b>Winter Weather Safety Continued</b>	<b>8</b>



# High Plains Herald

The National Weather Service provides weather forecasts and warnings for the protection of life and property and the enhancement of the national economy.

## Building a Weather-Ready Nation

Steven Aptel, MIC

When we think of NOAA's National Weather Service, our name says it all with "Service". Service to our customers and our partners has always been the key to our success as an agency. The core of the NWS mission is clear...to protect life and property and enhance the national economy. Whether it's making a decision about visiting the grandparents for the holidays, or allocating resources for a large wildfire, the NWS is committed to providing customers and partners with top quality service and support. One way we can do this is through building a Weather-Ready Nation. Being weather-ready is not a new concept, but it brings focus to how the NWS can help customers make an informed decision when weather hazards impact their lives. The United States experienced a record 14 high impact hazardous weather events in 2011 with damages of a billion dol-

lars or more. In 2012, record heat and drought conditions across the United States, and the devastating impacts from Hurricane / Extra tropical storm Sandy, have reinforced the need for increased preparedness during high impact weather events.

Weather-Ready nation (WRN) is a long term goal of NOAA's National Weather Service to help mitigate the impacts of high impact weather events through key initiatives and partnerships. The NWS is creating a roadmap for WRN by partnering with other government agencies, academia, and the private sector through: better science and technology for improved forecasts and warnings, improved decision support services, enhancing community preparedness, and overall increased effective communication. One of the ways NOAA's NWS Cheyenne, WY has helped support WRN is

through the installation of the new Dual-Polarization Radar upgrade in October, 2012. This upgrade in technology will help enhance both the horizontal and vertical detection of weather targets for improved warning and forecast services.

Weather-Ready Nation is evolving toward the future to change the way we do business and meet our customer's needs. From the local customer, to the first responder, to the large government agency, WRN strives to empower everyone to make smarter decisions to save lives and protect livelihood. Nobody knows what 2013 will bring, but NOAA's National Weather Service will be there to meet our mission and serve our customer. Weather-Ready Nation is more than a concept, but a plan of action to help us all enjoy better and safer lives.



## Building a Weather-Ready Nation

## Saving Lives and Livelihoods

*“...the number  
of possible  
combinations  
is almost  
infinite.”*

#### Inside this Issue:

<b>Building a Weather-Ready Nation</b>	<b>1</b>
<b>Weather 101: Snowflakes</b>	<b>2</b>
<b>Avalanche Safety Tips</b>	<b>3</b>
<b>El Niño and La Niña</b>	<b>4</b>
<b>El Niño and La Niña Continued</b>	<b>5</b>
<b>El Niño and La Niña Continued</b>	<b>6</b>
<b>Winter Weather Safety</b>	<b>7</b>
<b>Winter Weather Safety Continued</b>	<b>8</b>

## Weather 101: Is It True That No Two Snowflakes Are Alike?

By Debbie Winston

In the early stages of development, snowflakes are six-sided prisms, plates and columns of different sizes, so at this stage, snowflakes may be alike. Snowflakes are formed from water vapor which condenses into ice inside of the clouds. As this water vapor freezes into droplets they attach to the surface of a seed crystal. The patterns change as more and more frozen crystals attached to the seed crystal.

Water is H<sub>2</sub>O: one atom of oxygen and two atoms of Hydrogen. This combination is what causes the six sided shape we see in snowflakes. Water molecules like to form a hexagonal lattice.

Humidity influences the formation of the crystalline structure of snowflakes. When the humidity is low the snowflakes are simple plates or hexagonal blocks. When the humidity is higher the snowflakes form intricate branched structures. In this stage of development it is

most likely true that no two snowflakes are alike.

Scientists estimate that there are 10,000,000,000,000,000,000 water molecules in a typical snowflake and approximately 100 different features that can be seen when looking at a snowflake under a microscope, so it is easy to see the number of possible combinations is almost infinite. Experts agree the it is highly unlikely that two snowflakes would be identical.

The first research into the shapes of snowflakes was done by a photographer named Wilson Bentley. He was the first person to photograph a snowflake in 1885. He would catch snowflakes with a feather and place them on black velvet. He worked outside so that the snowflakes would not melt. Using a camera and a microscope. He was a pioneer in what is now called, “photomicrography” During his lifetime he photographed more than 5,000 snowflakes and he never found two the same.



## Avalanche Safety Tips

By Mike Weiland

An avalanche is a rapid flow of snow down a mountainside. In our area, avalanches can occur in some locations in the Snowy and Sierra Madre Ranges. Avalanches occur most frequently from December to April. Avalanches need a treeless slope that can receive significant snowfall. Avalanches can occur when temperatures warm after a significant snowfall.

Conditions for avalanche concerns are areas that have received fresh accumulation of wind driven snow. Also steep slopes in shady areas near a ridge are also areas of concern for avalanches.

A large avalanche can release the equivalent of 20 football fields to a depth of 10 feet. When there is that much snow moving down a mountainside, anything in its path, including skiers and those using snow

shoes will be swept away. Avalanches kill on average about xx people every year in the United States.

So what steps can you take to minimize your risk for being caught in an avalanche. First And foremost, recognize the potential signs and areas that we mentioned earlier. Also, pay attention to information issued by the Colorado Avalanche Center as to the avalanche potential. The possible avalanche days and areas should be avoided when enjoying the mountains. If you do go out in the mountains in the winter, some safety tips include...

- 1) Always travel with a partner.
- 2) Descend risky areas one at a time and watch for avalanche signs.
- 3) Wear an avalanche beacon that will signal your location.
- 4) Carry a small shovel and a long probe to locate a buried partner.
- 5) If caught in a slide, try to get off the slab or grab a tree.
- 6) If swept away, swim to the surface.



“... what steps can you take to minimize your risk for being caught in an avalanche.”

### Inside this Issue:

<b>Building a Weather-Ready Nation</b>	<b>1</b>
<b>Weather 101: Snowflakes</b>	<b>2</b>
<b>Avalanche Safety Tips</b>	<b>3</b>
<b>El Niño and La Niña</b>	<b>4</b>
<b>El Niño and La Niña Continued</b>	<b>5</b>
<b>El Niño and La Niña Continued</b>	<b>6</b>
<b>Winter Weather Safety</b>	<b>7</b>
<b>Winter Weather Safety Continued</b>	<b>8</b>





# Temperature, Precipitation and Wind Effects in this Area during El Niño and La Niña

By Rich Emanuel

El Nino and La Nina are conditions that occur over the tropical Pacific Ocean wherein the water temperatures become warmer or colder than normal, respectively. These anomalies in water temperatures in turn translate into the atmosphere and affect the circulation patterns over North America and the resultant sensible weather. An analysis of data does depict effects on temperature and precipitation in this area as a result of the altered weather patterns. In general, La Nina results in a more zonal or west-to-east wind flow across this area while El Nino tends to produce a more split-flow type pattern featuring two belts of stronger atmospheric winds, one across southern Canada into the Great Lakes region and the other across the southern part into the southeastern part of the U.S.

## Temperature:

The following table shows the departures from normal temperatures for three select cities across southeast Wyoming and the Nebraska panhandle during both the winter season (December through February) and the period of time when El Nino and La Nina tend to exert their greatest effects, typically October through March:

Oct-Mar and Dec-Feb Temperature Anomalies								
La Nina Years								
	Cheyenne			Rawlins			Scottsbluff	
	OCT-MAR	DEC-FEB		OCT-MAR	DEC-FEB		OCT-MAR	DEC-FEB
Avg Temp	33.5	28.5		29.1	23.1		34.3	27.8
2011-2012	35.1	28.0		30.5	22.7		37.2	28.7
2010-2011	34.0	27.4		29.7	22.2		35.3	27.7
2008-2009	35.1	29.3		30.5	24.0		35.5	28.8
2007-2008	32.9	25.5		27.0	18.1		32.8	26.0
2000-2001	31.2	26.6		24.7	18.8		32.3	26.2
1999-2000	37.5	32.2		36.4	30.2		38.6	32.9
1998-1999	35.8	30.7		34.2	27.9		37.3	31.8
1988-1989	33.2	25.4		28.6	19.1		33.4	25.6
1984-1985	30.0	23.3		25.3	17.6		32.4	23.7
El Nino Years								
	Cheyenne			Rawlins			Scottsbluff	
	OCT-MAR	DEC-FEB		OCT-MAR	DEC-FEB		OCT-MAR	DEC-FEB
Avg Temp	33.5	28.5		29.1	23.1		34.3	27.8
2009-2010	30.9	24.9		27.0	19.6		32.4	24.3
2006-2007	34.0	26.9		29.1	20.8		34.3	26.4
2004-2005	35.9	32.1		31.8	27.2		36.3	31.2
2002-2003	33.9	30.7		29.6	25.6		34.5	29.8
1997-1998	33.3	29.8		31.3	26.9		35.1	31.1
1994-1995	35.8	32.2		32.2	27.9		35.2	29.4
1991-1992	35.9	32.9		30.6	24.3		37.0	33.6
1986-1987	33.5	29.8		28.0	22.6		34.7	30.4
1982-1983	33.8	31.5		29.4	25.1		36.1	32.3

	> 2.0 degrees above average
	Between 1 and 2 degrees above average
	Within 1 degree of average
	Between 1 and 2 degrees below average
	> 2.0 degrees below average

Continued on Next Page

## Inside this Issue:

Building a Weather-Ready Nation	1
Weather 101: Snowlakes	2
Avalanche Safety Tips	3
El Niño and La Niña	4
El Niño and La Niña Continued	5
El Niño and La Niña Continued	6
Winter Weather Safety	7
Winter Weather Safety Continued	8



## Temperature, Precipitation and Wind Effects in this Area during El Niño and La Niña Continued By Rich Emanuel

As can be derived from the tables, cooler than normal temperatures tend to occur in this area during La Nina events, especially during the winter months, while warmer than normal temperatures tend to occur during El Nino. This is usually due to the split-flow regime during El Nino keeping colder Canadian and Arctic air north and northeast of the area. An obvious exception was during the El Nino of 2009-2010, where it was still much colder than normal. In that case a strong negative Arctic Oscillation (pressure anomaly over the North Atlantic into the Arctic regions) basically overrode the El Nino tendency, allowing for arctic air intrusions into much of the country. Likewise for the La Nina event of 1998 into 2000, where it was much warmer than normal likely due at least in part to a strongly positive Arctic Oscillation.

### Precipitation:

The altered patterns due to El Nino and La Nina also affect precipitation across the area during the colder time of year, including the amount of accumulated snow over the mountains, which translates into available water once it melts and flows into area reservoirs. The next table depicts precipitation amounts and how they departed from normal during El Nino and la Nina events since 1982:

Oct-Mar and Dec-Feb Precipitation Anomalies						
La Nina Years						
	Cheyenne		Rawlins		Scottsbluff	
	OCT-MAR	DEC-FEB	OCT-MAR	DEC-FEB	OCT-MAR	DEC-FEB
Avg Pcpn	3.86	1.29	3.19	1.21	4.32	1.52
2011-2012	4.06	1.52	3.32	1.18	3.03	1.19
2010-2011	3.67	1.34	4.22	3.34	4.43	1.83
2008-2009	3.04	1.35	5.28	2.85	3.23	1.37
2007-2008	3.54	1.20	3.15	1.23	3.24	1.64
2000-2001	3.04	1.49	2.00	0.69	4.07	0.81
1999-2000	3.13	1.13	2.85	2.01	2.84	1.50
1998-1999	2.98	0.94	3.69	1.39	6.14	1.15
1988-1989	3.06	2.06	3.20	1.72	2.77	1.43
1984-1985	3.21	1.19	2.17	0.89	2.87	1.34
El Nino Years						
	Cheyenne		Rawlins		Scottsbluff	
	OCT-MAR	DEC-FEB	OCT-MAR	DEC-FEB	OCT-MAR	DEC-FEB
Avg Pcpn	3.86	1.29	3.19	1.21	4.32	1.52
2009-2010	5.67	1.45	3.40	1.07	4.99	1.70
2006-2007	4.26	2.21	2.66	0.25	3.90	1.65
2004-2005	3.95	0.88	2.30	1.02	4.74	0.97
2002-2003	4.46	0.67	2.32	0.31	3.70	0.89
1997-1998	2.93	0.95	4.47	1.73	4.39	1.15
1994-1995	3.79	1.71	3.03	0.96	6.39	2.62
1991-1992	4.48	1.42	3.13	1.63	4.80	1.69
1986-1987	4.86	1.17	4.13	1.17	6.41	2.48
1982-1983	5.44	0.85	2.24	0.95	4.86	0.90

	Greater than 50% above normal
	From 11% to 50% above normal
	Within 10% of normal
	From 11% to 50% below normal
	Greater than 50% below normal

Continued on Next Page



### Inside this Issue:

**Building a Weather-Ready Nation** 1

**Weather 101: Snowflakes** 2

**Avalanche Safety Tips** 3

**El Niño and La Niña** 4

**El Niño and La Niña Continued** 5

**El Niño and La Niña Continued** 6

**Winter Weather Safety** 7

**Winter Weather Safety Continued** 8

### Inside this Issue:

**Building a Weather-Ready Nation** 1

**Weather 101: Snowflakes** 2

**Avalanche Safety Tips** 3

**El Niño and La Niña** 4

**El Niño and La Niña Continued** 5

**El Niño and La Niña Continued** 6

**Winter Weather Safety** 7

**Winter Weather Safety Continued** 8



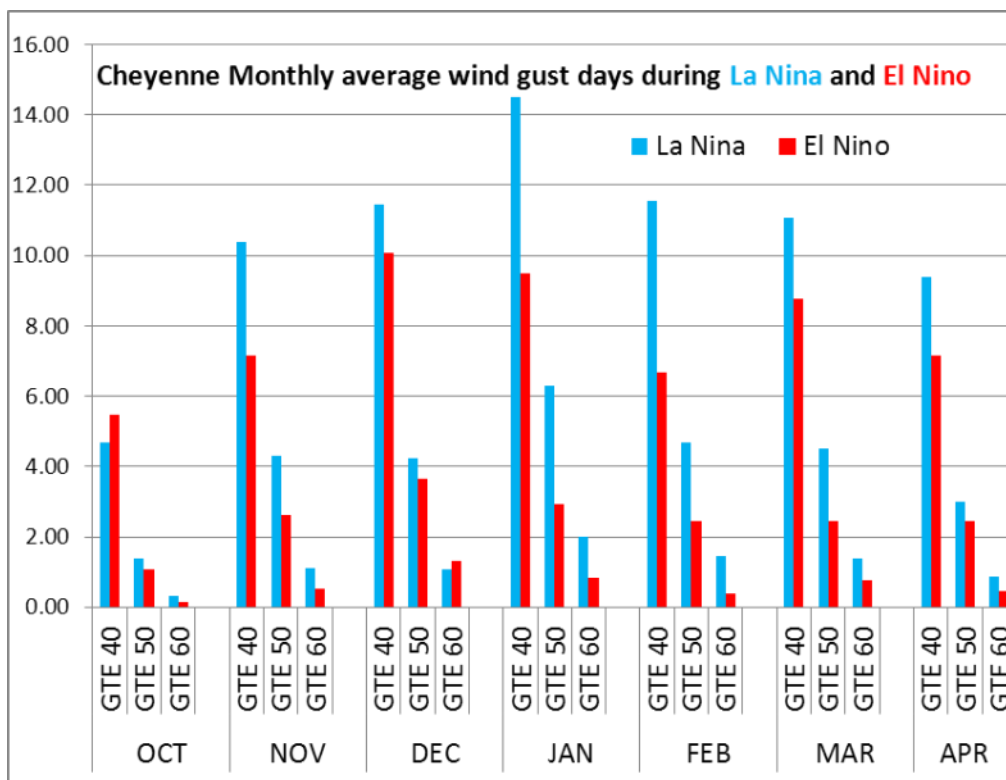
## Temperature, Precipitation and Wind Effects in this Area during El Niño and La Niña Continued

By Rich Emanuel

Here, drier than normal conditions tend to result over the plains during La Nina with enhanced precipitation over the mountains and the intermountain valleys and lower elevations. During El Nino the reverse effect can be seen overall. The general west-to-east wind flow during La Nina usually causes systems to drop much of their precipitation over the mountains, then as that air descends over the plains east of the mountains it warms and dries, reducing the precipitation significantly. During El Nino, low pressure systems tend to develop over the plains of eastern Colorado, setting up a more easterly flow across the plains of Wyoming into the Nebraska panhandle which causes upslope flow, enhancing precipitation in those areas.

### Wind:

The following table shows the difference in the number of windy days in Cheyenne during La Nina and El Nino events. The numbers depict the number of days each month with wind gusts of greater than or equal to 40 mph (GTE 40), 50 mph (GTE 50), and 60 mph (GTE 60).



As can be discerned by the table, it is considerably windier during La Nina than El Nino. This is a direct function of the stronger atmospheric winds that occur over this area during La Nina.

What's the outlook for this winter? Earlier it appeared El Nino was developing, but it has weakened recently. The latest outlook now favors either neutral conditions or a weak El Nino during the winter into next spring.

facebook



US National Weather Service Cheyenne WY



**US National Weather Service Cheyenne Wyoming**



Like Us on Facebook

## Winter Weather Safety

By climatological standards, winter is defined by the months of December, January and February. However, winter weather in Wyoming and Nebraska can occur from September through May. Winter weather includes snow, ice, sleet, freezing rain and cold.

Winter storms require three ingredients to form: subfreezing temperatures in the clouds and near the surface, a moisture source like the Pacific or Gulf of Mexico, and lift from warm air colliding with cold air, or air forced up a mountain range (orographic lift). Winter storms can range from a moderate snow over a few hours to a blizzard with blinding, wind-driven snow that can last for several days. Some winter storms are large enough to affect several states, while others affect only single states or counties. Many winter storms are accompanied by dangerously cold temperatures and sometimes by strong winds, icing, sleet and freezing rain.

Winter weather, too often catches people unprepared. Seventy percent of the fatalities related to ice and snow result from automobile accidents, about 25 percent of all winter related fatalities are people that are caught out in the storm, and most fatalities happen to males over 40 years old. What winter weather preparations are being made in your area and what are the appropriate steps to take that will ensure your winter weather safety?

The National Weather Service uses specific winter weather terms to ensure that the public understands what to expect in the coming days and hours. A **Winter Storm Watch** means that severe winter conditions, such as heavy snow and/or ice, may affect your area, but its occurrence, location and timing are still uncertain. A win-

ter storm watch is issued to provide 12 to 36 hours notice of the possibility of severe winter weather. A winter storm watch is intended to provide enough lead time so those who need to set plans in motion can do so. A watch is upgraded to a **Winter Storm Warning** when 4 or more inches of snow or sleet is expected in the next 12 hours, or 6 or more inches in 24 hours, or 1/4 inch or more of ice accumulation is expected. **Winter Weather Advisories** inform you that winter weather conditions are expected to cause significant inconveniences that may be hazardous. If caution is exercised, advisory situations should not become life-threatening. A **Blizzard Warning** means that snow and strong winds will combine to produce a blinding snow (near zero visibility), deep drifts, and life-threatening wind chill. Listen to the radio, television, and NOAA All Hazards Radio for the latest winter storm watches, warnings, and advisories.

Heavy snow can immobilize a region and paralyze a city, stranding commuters, closing airports and schools, and disrupting emergency and medical services. Large snow accumulations can cause roofs to collapse and knock down trees and power lines. Residences and farms may be isolated for days and unprotected livestock may be lost. In mountainous areas, heavy snow can lead to avalanches. The cost of snow removal, repairing damages, and the loss of businesses can have severe economic impacts on cities and towns.

Heavy ice accumulations can topple trees, utility poles and communication towers. Ice storms can disrupt communications and power for days. Small accumulations of ice can

be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly treacherous because they freeze before other surfaces.

Prolonged exposure to cold temperatures can lead to frostbite and hypothermia and become life-threatening. Infants and the elderly are the most susceptible. Freezing temperatures can cause severe damage to vegetation. Pipes can freeze and burst in poorly insulated homes. Extreme cold means temperatures well below zero.

Wind chill is a measure of how wind and cold feel on exposed skin. As wind increases, heat is carried from the body at a faster rate, lowering the body temperature.

Winter storms can cause ice jams and snow melt, resulting in damage and loss of life. Prolonged cold spells can cause rivers, streams and lakes to freeze. A rise in the water level or thaw breaks the ice into large chunks which become jammed at man-made and natural obstructions. Ice jams can act as dams, resulting in severe flooding. Sudden thawing of a heavy snow pack often leads to flooding.

Prolonged exposure to cold temperatures can lead to frostbite and hypothermia and become life-threatening. Infants and the elderly are the most susceptible. Freezing temperatures can cause severe damage to vegetation. Pipes can freeze and burst in poorly insulated homes. Extreme cold means temperatures well below zero.

Wind chill is a measure of how wind and cold feel on exposed skin. As wind increases, heat is carried from the body at a faster rate, lowering the body temperature.

**Continued on next page.**

By Mike Jamski

### Inside this Issue:

<b>Building a Weather-Ready Nation</b>	<b>1</b>
<b>Weather 101: Snowflakes</b>	<b>2</b>
<b>Avalanche Safety Tips</b>	<b>3</b>
<b>El Niño and La Niña</b>	<b>4</b>
<b>El Niño and La Niña Continued</b>	<b>5</b>
<b>El Niño and La Niña Continued</b>	<b>6</b>
<b>Winter Weather Safety</b>	<b>7</b>
<b>Winter Weather Safety Continued</b>	<b>8</b>



“Winter weather, too often catches people unprepared.”

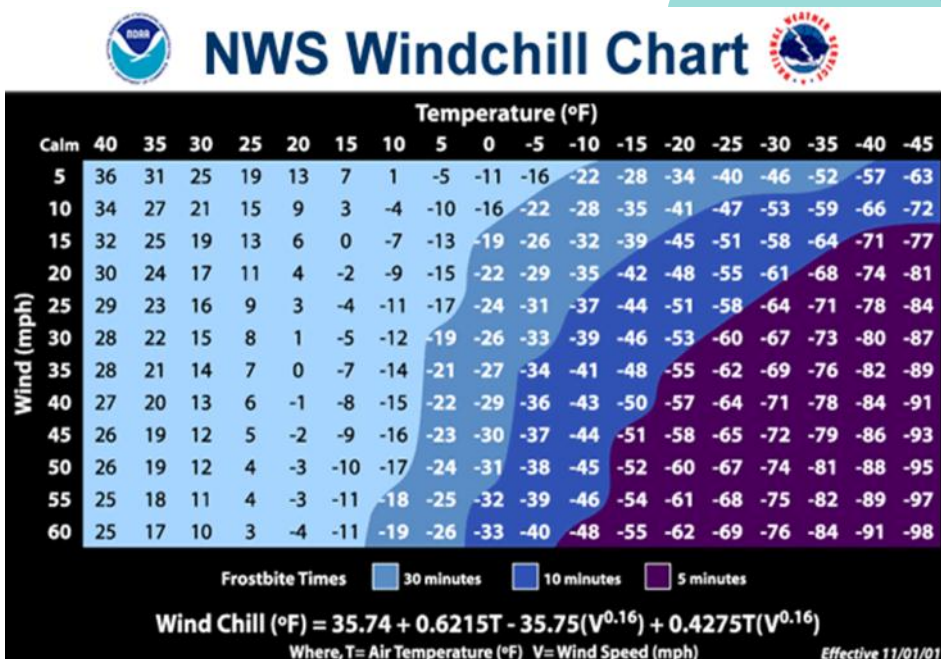


## Winter Weather Safety Continued

By Mike Jamski

Frostbite is damage to body tissue due to extreme cold. A wind chill of -20F will cause frostbite in 30 minutes. Frostbite causes numbness and a white or pale appearance to extremities. If symptoms develop, slowly re-warm affected areas and get medical help immediately. Hypothermia occurs when the body temperature drops below 95F. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, and drowsiness. Seek medical attention immediately!

Preparations before the winter storm strikes are paramount to safety and survival. At home and work, primary concerns are loss of heat, power and communications, and a shortage of supplies if storm conditions last for several days. Items to have on hand include flashlight and batteries; battery powered NOAA All Hazards Radio; extra food, medicines and water; first aid supplies; emergency heat sources; fire extinguisher and alarm; and shelter for pets. Plan your travel accordingly and check the latest road and weather reports to avoid the storm. It's recommended that your vehicle is winterized before the season begins. Your vehicle should contain a survival kit, a full tank of gas to avoid ice in the tank, never travel alone, and inform others of your timetable and travel routes. Farmers should move their livestock to shelter, haul extra feed to feeding areas, and have plenty of water available.



If you're caught outside in a winter storm, find shelter as soon as possible. Try to stay dry and cover exposed body parts. If no shelter is available, build a lean-to or snow cave for protection from the wind, build a fire and place rocks around it to absorb and reflect heat. Melt snow for drinking water. If trapped in your vehicle, remain inside and run your engine 10 minutes each hour for heat. Keep the exhaust pipe is clear of snow to prevent carbon monoxide poisoning. Open the window for fresh air. To be seen at night, turn on the dome light, tie a colored cloth to the antenna or door, and raise the hood. To keep warm and blood circulating, move arms, legs, fingers and toes vigorously. If indoors during the storm, cover windows at night, close off unneeded rooms, and replenish the body with food and drink. Avoid overexertion, like shoveling snow, pushing a car or walking in deep snow. The strain from

the cold and hard labor may cause a heart attack. Sweating could result in chills and hypothermia. If you must venture outdoors, wear several layers of loose-fitting, lightweight clothing.

In preparation for winter weather hazards, ensure your family has a disaster plan. Contact your local National Weather Service office, county emergency management agency or American Red Cross for information. Discuss your plan with your family. Implement your emergency plan. Practice and maintain your emergency plan.

## Be Prepared!



### Inside this Issue:

**Building a Weather-Ready Nation**

1

**Weather 101: Snowflakes**

2

**Avalanche Safety Tips**

3

**El Niño and La Niña**

4

**El Niño and La Niña Continued**

5

**El Niño and La Niña Continued**

6

**Winter Weather Safety**

7

**Winter Weather Safety Continued**

8